

Claims:

1 1. A device for in-situ measurement and recording of at least one parameter in a
2 process, said device comprising:

3 a sensor for detecting said parameter and converting to a sensor output; and

4 a data logger coupled to said sensor for receiving and logging said sensor output.

1 2. The device of claim 1 wherein said data logger comprises a timestamping module
2 for recording a timestamp with said sensor output.

1 3. The device of claim 2 further comprising a communication module for
2 communicating said sensor output.

1 4. The device of claim 3 wherein said communication module comprises a
2 transmitter and a receiver.

1 5. The device of claim 3 wherein said communication module comprises an RF
2 (radio frequency) communication module.

1 6. The device of claim 1 further comprising a display device.

1 7. The device of claim 1 wherein said sensor is configured to detect a presence of
2 electrostatic field.

1 8. The device of claim 7 wherein said sensor is configured to measure a magnitude
2 of said electrostatic field.

1 9. The device of claim 8 wherein said sensor is configured to detect a change in said
2 electrostatic field.

1 10. The device of claim 1 wherein said sensor is configured to detect an electrostatic
2 discharge.

1 11. The device of claim 10 wherein said sensor is configured to measure a magnitude
2 of said electrostatic discharge.

1 12. The device of claim 1 wherein said data logger comprises an analog to digital
2 converter (ADC) to convert said sensor output into digital data.

1 13. The device of claim 12 further comprising signal processing circuitry coupled to
2 said sensor for processing said sensor output.

1 14. A device for in-situ measurement and recording of at least one parameter in a
2 process, said device comprising:
3 means for detecting said parameter and converting to a sensor output; and
4 means for receiving and logging said sensor output.

1 15. The device of claim 14 wherein said means for receiving and logging comprises a
2 timestamping module for recording a timestamp with said sensor output.

1 16. The device of claim 13 further comprising means for communicating said sensor
2 output.

1 17. The device of claim 16 wherein said means for communicating comprises a
2 transmitter and a receiver.

1 18. The device of claim 16 wherein said means for communicating comprises an RF
2 (radio frequency) communication module.

1 19. A method for in-situ measurement and recording of at least one parameter in a
2 semiconductor fabrication process comprising a plurality of stages, said method comprising:

- 3 (a) monitoring said parameter in a stage of said plurality of stages;
- 4 (b) converting said parameter into data;
- 5 (c) logging said data and an identification of said stage; and
- 6 (d) repeating (a) – (d) for said plurality of stages.

1 20. The method of claim 19 further comprising timestamping said data.

1 21. The method of claim 20 further comprising signal processing said data.

1 22. The method of claim 21 further comprising converting said data into digital data.

1 23. The method of claim 22 further comprising communicating said digital data and
2 said identification of said stage to a base equipment.

1 24. The method of claim 23 wherein said parameter comprises electrostatic field.

1 25. The method of claim 24 wherein said parameter comprises a change in said
2 electrostatic field.

1 26. The method of claim 25 wherein said parameter comprises an electrostatic
2 discharge.

1 27. The method of claim 26 further comprising eliminating extraneous electrostatic
2 discharges based on said electrostatic discharge and said electrostatic field.

1 28. A device for in-situ monitoring of at least one environmental parameter in a
2 photolithographic process comprising a plurality of stages, said device comprising:
3 at least one sensor for converting said environmental parameter of an associated stage
4 into a sensor output;
5 an analog to digital converter for converting said sensor output to digital data; and
6 a communication module to communicate said digital data and an identification of said
7 associated stage of said plurality of stages.

1 29. The device of claim 28 further comprising a data logger for logging said digital
2 data and said identification of said associated stage.

1 30. The device of claim 29 wherein said communication module comprises a
2 transmitter and a receiver.

1 31. The device of claim 29 wherein said communication module comprises an RF
2 (radio frequency) communication module.

1 32. The device of claim 28 further comprising a display device. _

1 33. The device of claim 28 further comprising a sensor for detecting a presence of
2 electrostatic field.

1 34. The device of claim 33 wherein said sensor is configured to measure a magnitude
2 of said electrostatic field.

1 35. The device of claim 34 wherein said sensor is configured to detect a change in
2 said electrostatic field.

1 36. The device of claim 28 further comprising a sensor for detecting an electrostatic
2 discharge.

1 37. The device of claim 36 wherein said sensor is configured to measure a magnitude
2 of said electrostatic discharge.

1 38. The device of claim 28 further comprising signal processing circuitry coupled to
2 said plurality of sensors for processing said sensor output.

1 39. A device for use in conjunction with a reticle for in-situ monitoring of at least one
2 electrical parameter in a semiconductor fabrication process comprising a plurality of stages, said
3 device comprising:

4 a sensor for converting said electrical parameter of a stage into a sensor output;

5 an analog to digital converter for converting said sensor output to digital data;

6 a data logger comprising a timestamping module for logging said digital data and an
7 identification of said stage; and

8 an RF (radio frequency) communication module coupled to said data logger.

1 40. The device of claim 39 wherein said electrical parameter comprises electrostatic
2 field.

1 41. The device of claim 39 wherein electrical parameter comprises an electrostatic
2 discharge.

1 42. A method for in-situ measurement and recording of at least one parameter in a
2 semiconductor fabrication process comprising at least one stage, said method comprising:

- 3 (a) monitoring said parameter in said stage;
- 4 (b) converting said parameter into data; and
- 5 (c) logging said data and an identification of said stage.

1 43. The method of claim 42 further comprising
2 timestamping said data.

1 44. The method of claim 43 further comprising:
2 signal processing said data.

1 45. The method of claim 44 further comprising:
2 converting said data into digital data.

1 46. The method of claim 44 further comprising:
2 communicating said digital data and said identification of said stage to a base equipment.

1 47. The method of claim 46 wherein said parameter comprises electrostatic field.

1 48. The method of claim 46 wherein said parameter comprises an electrostatic
2 discharge.

1 49. A device for monitoring environmental parameters comprising:
2 an electrostatic sensor for detecting electrostatic field and converting said electrostatic
3 field into a first output;

4 an electrostatic discharge (ESD) sensor for detecting an electrostatic discharge and
5 converting said electrostatic discharge into a second sensor output;

6 an analog to digital converter coupled to said electrostatic sensor and said ESD sensor for
7 converting said first and second sensor outputs to first and second digital data, respectively; and
8 a data logger comprising a timestamping module for logging said first and second digital
9 data.

1 50. The device of claim 49 further comprising an RF (radio frequency)
2 communication module coupled to said data logger.

1 51 A method for localizing electrostatic discharges (ESD) by detecting electrostatic
2 discharges and electrostatic field, the method comprising:

3 detecting an electrostatic discharge and converting it into a first output;
4 detecting said electrostatic field and converting it into a second output; and
5 determining a valid local electrostatic discharge based on said first and second outputs.

1 52. The method of claim 51 wherein said determining comprises determining said
2 valid local electrostatic discharge when said electrostatic discharge is combined with said
3 electrostatic field having a magnitude that exceeds a predetermined value.

1 53. The method of claim 52 further comprising converting said first and second
2 outputs to first and second digital data, respectively.

1 54. A device for localizing electrostatic discharges affecting a unit by detecting an
2 electrostatic discharge and electrostatic field, the device comprising:

3 an electrostatic sensor for detecting said electrostatic field affecting said unit and
4 generating a first output; and

5 an ESD sensor for detecting said electrostatic discharge affecting said unit and generating
6 a second output.

1 55. The device of claim 54 further comprising:

2 an analog comparator coupled to said first output for generating a comparator output
3 when said electrostatic field has a magnitude exceeding a predetermined value.

1 56. The device of claim 55 further comprising:
2 a circuit coupled to said analog comparator and to said ESD sensor for receiving said
3 comparator output and said second output, said circuit configured to generate a valid ESD signal
4 when said comparator output and said second output are detected.

1 57. The device of claim 54 further comprising:
2 an analog to digital converter (ADC) coupled to said electrostatic sensor and said ESD
3 sensor for converting said first and second outputs to first and second digital data, respectively.

1 58. The device of claim 57 further comprising:
2 a digital comparator coupled to said first data and generating a comparator output when
3 said electrostatic field has a magnitude exceeding a predetermined value.

1 59. The device of claim 58 further comprising:
2 a circuit coupled to said digital comparator and to said ADC for receiving said
3 comparator output and said second data, said circuit configured to generate a valid ESD signal
4 when said comparator output and said second data are detected.

1 60. The device of claim 59 wherein said circuit is an AND gate.

1 61. The device of claim 60 further comprising:
2 a data logger comprising a timestamping module for logging said first and second digital
3 data.

1 62. The device of claim 61 further comprising an RF (radio frequency)
2 communication module coupled to said data logger.

1 63. A method for localizing electrostatic discharges (ESD) by detecting electrostatic
2 discharges and electrostatic field, the method comprising:
3 detecting an electrostatic discharge and converting it into a first output;

4 detecting a change in said electrostatic field and converting it into a second output; and
5 determining a valid local electrostatic discharge based on said first and second outputs.

1 64. The method of claim 63 wherein said determining comprises determining said
2 valid local electrostatic discharge when said electrostatic discharge is combined with said
3 electrostatic field changing at a rate that exceeds a predetermined value.

1 65. The method of claim 64 further comprising converting said first and second
2 outputs to first and second digital data, respectively.

1 66. A device for localizing electrostatic discharges affecting a unit by detecting an
2 electrostatic discharge and electrostatic field;
3 an electrostatic sensor for detecting a change in said electrostatic field and generating a
4 first output; and
5 an ESD sensor for detecting said electrostatic discharge and generating a second output.

1 67. The device of claim 66 further comprising:
2 a high pass filter coupled to said first output for generating a high pass filter output when
3 said electrostatic field changes at a rate exceeding a predetermined value.

1 68. The device of claim 67 further comprising:
2 a circuit coupled to said high pass filter and to said ESD sensor for receiving said high
3 pass filter output and said second output, said circuit configured to generate a valid ESD signal
4 when said high pass filter output and said second output are detected.

1 69. The device of claim 68 further comprising:
2 an analog to digital converter (ADC) coupled to said electrostatic sensor and said ESD
3 sensor for converting said first and second outputs to first and second digital data, respectively.

1 70. The device of claim 69 further comprising:
2 a high pass filter coupled to said first data for generating a high pass filter output when
3 said electrostatic field changes at a rate exceeding a predetermined value.

1 71. The device of claim 70 wherein said high pass filter comprises software codes
2 executable by a microprocessor.

1 72. The device of claim 70 further comprising:
2 a circuit coupled to said high pass filter and to said ADC for receiving said high pass
3 filter output and said second data, said circuit configured to generate a valid ESD signal when
4 said high pass filter output and said second data are detected.

1 73. The device of claim 72 wherein said circuit is an AND gate.

1 74. The device of claim 73 further comprising:
2 a data logger comprising a timestamping module for logging said first and second digital
3 data.

1 75. The device of claim 74 further comprising an RF (radio frequency)
2 communication module coupled to said data logger.